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UMCA researchers study conservation measures to reduce dead zone in Gulf

In 2001, the U.S. Environmental Protection Agency set an ambitious goal: to shrink the dead zone from its average of 4,200 square miles to around 1,900 square miles by 2015. A key objective was to reduce the amount of agricultural nutrients flowing into the Mississippi River and its tributaries. Scientists have long argued that fertilizer runoff contributed to a vast hypoxic area in the gulf, a "dead zone" where oxygen levels fall too low to support most marine life. While agriculture isn't the dead zone's sole cause — discharges from sewage treatment plants and fertilizers from lawns also contribute — "agricultural sources contribute more than 70 percent of the nitrogen and phosphorous delivered to the Gulf," according to a U.S. Geological Survey report. Taking steps to limit this runoff, the EPA argued, would almost certainly reduce its size. Researchers estimated that the 2013 dead zone encompassed 5,840 square miles — more than three times next year's target.

What went wrong? University of Missouri researchers, who for years have studied nutrient runoff, say that the EPA plan underestimated both the scale of the problem and the complexity of interventions intended to solve it. Now, they say, a new federally funded, multistate initiative in progress could finally provide workable solutions. The project, called the Mississippi River Basin Healthy Watersheds Initiative, or MRBI, is funded by the USDA's Natural Resources Conservation Service, or NRCS. In Missouri, a team led by Ranjith Udawatta, an MU associate professor of agroforestry, is monitoring runoff water from a dozen farms, measuring the effectiveness of various conservation practices. The aim is to determine how well the practices keep nutrients and sediment in row-crop fields and out of surface water. Research teams in 12 other states are doing much the same.

Infographic courtesy of The Times-Picayune

UMCA researchers are testing conservation measures to hopefully reduce the Gulf of Mexico's dead zone.

The University is providing monitoring for farms located both in north central Missouri and in the Bootheel. The choice of conservation practice (e.g., sowing cover crops, rotating crops, reducing tillage, terracing, using a variable rate of fertilizer application, or employing grass and tree buffers) will be up to the farmers. The watersheds studied will be small, between three and 12 acre, and studied in pairs, with one watershed in each pair serving as the control.

"Identifying the best mitigation strategies will benefit farmers who want to keep valuable topsoil and nutrients on the farm," Udawatta said. "By slowing or reducing runoff, farmers will be able to employ nutrients and fertilizers more efficiently, obtain greater crop yields and save money in the process." Udawatta indicated that the data will help judge both the effectiveness of various runoff-mitigation practices and develop models to determine how it might work on a larger scale. "We're excited because we're getting a chance to scale up some of our own research," UMCA's Shibu Jose said. "This is a once-in-a-lifetime opportunity. As researchers, we often get to play with small-scale plots, mostly on university experimental farms, but this is expanding that concept on such a large scale, with, hopefully, a very positive outcome: reducing hypoxia in the Gulf of Mexico." -- *Anita N. Harrison. (2014.) Watershed Revival. Illumination.*

RESEARCH

Endocrine Disrupting Activity of Hydraulic Fracturing Chemicals and in Vivo Adverse Health Outcomes

Many chemicals used in hydraulic fracturing (fracking) can disrupt not only the human body's reproductive hormones but also the glucocorticoid and thyroid hormone receptors, which are necessary to maintain good health, a new study finds. The results were presented by a team of researchers from MU (Christopher D. Kassotis, Chung-Ho Lin and Susan Nagel) and the USGS (Donald Tillitt) on June 23, at the joint meeting of the International Society of Endocrinology and the Endocrine Society (ICE/ENDO 2014).

There has been a rapid rise in the use of fracking to produce natural gas and oil. Over 750 chemicals are used in this process and many are known toxicants, carcinogens, and/or endocrine disrupting chemicals (EDCs). Spills of wastewater associated with this process are common and can contaminate surface and ground water. We have previously found an association between hydraulic fracturing spills and endocrine disrupting activity. Water samples collected from sites with documented natural gas drilling contamination exhibited the highest levels of activity, samples collected from the Colorado River had intermediate levels of activity, and reference sites in areas away from natural gas drilling exhibited the lowest levels.

Earlier research found that eleven of twelve chemicals used in hydraulic fracturing exhibited significant anti-estrogenic activity and nine exhibited significant anti-androgenic activity. Based on this small subset of chemicals and the vast number of chemicals used, the research team hypothesized that a wider analysis of chemicals would reveal other hormonally active chemicals. This study extends the analysis to include agonist and antagonist activities of the estrogen, androgen, progesterone, glucocorticoid, and thyroid receptors for 24 individual chemicals used in the fracturing process. To date, we have identified 19, 16, 7, 7, and 5 chemicals that exhibit antagonist activities for the estrogen, androgen, progesterone, glucocorticoid, and thyroid receptors, respectively.

Previous work has reported additivity of EDCs with the same mechanism of action. With hundreds of chemicals used, it is essential to begin to assess in vitro and in vivo effects of complex mixtures of the EDCs used throughout the natural gas drilling process. Overall, we have shown that many chemicals used in hydraulic fracturing are EDCs. Completion of the in vivo studies will substantially increase our knowledge associated with exposure to complex mixtures of EDCs used in hydraulic fracturing and increase our understanding of the potential health risks.

Stein named NAC Director

Susan Stein has been selected to be the Director of the USDA National Agroforestry Center. Previously, Stein served as the Interim Assistant Director for U.S. Forest Service Cooperative Forestry. She has advised Forest Service units on compliance with the National Environmental Policy Act, managed the national Forest Stewardship Program, and coordinated a White House Interagency Ecosystem Management Working Group.

She also served as the International Programs agroforestry coordinator, advising USAID missions on project design and improvement, providing training on project implementation, and synthesizing research. She has lead efforts to integrate open space conservation tools and practices into Forest Service programs and produced Forests on the Edge publications.

She earned her masters from the Yale School of Forestry, and an undergraduate degree in Psychobiology from Mount Holyoke College.

Upcoming Events

August 10-13, 2014— Northern Nut Growers Association Annual Meeting; Oregon State University, Corvallis, OR.
Find out more at: www.nutgrowing.org

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